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Observations of Phenomena of Jupiter's Satellites at Windsor, New South Wales, in the Year 1889. By John Tebbutt.

Day of Obs.	Satellite.	Phenomenon.	Phase.	Aperture of Telescope.	Mag. Power.	Greenwich Mean Time of Observation.	Mean Time of Nautical Almanac.
1889.						h m s	h m s
May 9	I.	Ecl. D.	Last seen	8-inch	75	1 0 31	1 0 2
21	III.	,,	Began to fade	,,	,,	5 52 52	5 57 30
21	III.	,,	Last seen	,,	,,	5 59 58	
June 1	I.	Tr. Ingr.	Ext. contact	,,	130	22 47 8	22 49
1	I.	,,	Bisection	,,	,,	22 49 5	
1	I.	,,	Int. contact	,,	,,	22 51 34	
2	I.	Tr. Egr.	Int. contact	,,	,,	0 59 53	1 6
2	I.	,,	Bisection	,,	,,	1 1 38	
2	I.	,,	Ext. contact	,,	,,	1 4 22	
2	I.	Occ. R.	Bisection	4½-inch	90	22 24 17	22 24
2	I.	,,	Last contact	,,	,,	22 26 17	
9	I.	Ecl. D.	Began to fade	,,	,,	21 29 18	21 33 4
9	I.	,,	Last seen	,,	,,	21 33 26	

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Day of Obs.	Satellite.	Phenomenon.	Phase.	Aperture of Telescope.	Mag. Power.	Greenwich Mean Time of Observation.	Mean Time of Nautical Almanac.
1889.						h m s	h m s
June 10	I.	Occ. R.	Last contact	8-inch	130	0 9 26	0 8
10	I.	Tr. Egr.	Int. contact	$4\frac{1}{2}$-inch	90	21 9 35	
10	I.	"	Bisection	"	"	21 12 20	21 16
10	I.	"	Ext. contact	"	"	21 14 59	
12	II.	Tr. Ingr.	Ext. contact	8-inch	110	21 36 38	
12	II.	"	Bisection	"	"	21 39 7	21 40
12	II.	"	Int. contact	"	"	21 42 22	
13	II.	Tr. Egr.	Int. contact	"	75	0 12 22	
13	II.	"	Bisection	"	"	0 16 41	0 19
13	II.	"	Ext. contact	"	"	0 20 10	
16	I.	Ecl. D.	Began to fade	"	"	23 24 44	23 27 18
16	I.	"	Last seen	"	"	23 27 44	
17	I.	Tr. Egr.	Int. contact	"	"	22 52 53	
17	I.	"	Bisection	"	"	22 55 47	22 59
17	I.	"	Ext. contact	"	"	22 59 32	
21	IV.	Tr. Ingr.	Ext. contact	"	110	0 19 59	0 46

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Day of Obs.	Satellite.	Phenomenon.	Phase.	Aperture of Telescope.	Mag. Power.	Greenwich Mean Time of Observation.	Mean Time of Nautical Almanac.
1889.						h m s	h m s
June 21	IV.	Tr. Egr.	Ext. contact	8-inch	110	1 7 51	1 0
24	I.	Tr. Ingr.	Ext. contact	,,	70	22 22 58	
24	I.	,,	Bisection	,,	,,	22 25 33	22 26
24	I.	,,	Int. contact	,,	,,	22 29 27	
25	I.	Occ. R.	Last contact	,,	,,	22 6 30	
28	II.	Occ. D.	First contact	4½-inch	90	20 11 1	
28	II.	,,	Bisection	,,	,,	20 14 20	20 15
28	II.	,,	Last seen	,,	,,	20 16 0	
28	II.	Ecl. R.	First seen	8-inch	70	23 5 29	23 5 17
28	II.	,,	Full brightness	,,	,,	23 7 26	
July 6	III.	Tr. Egr.	Int. contact	,,	,,	21 2 42	
6	III.	,,	Bisection	,,	,,	21 6 57	21 13
6	III.	,,	Ext. contact	,,	,,	21 13 11	
9	I.	Occ. D.	First contact	,,	,,	23 11 8	
9	I.	,,	Bisection	,,	,,	23 13 47	23 14
9	I.	,,	Last seen	,,	,,	23 15 47	

Day of Obs.	Satellite.	Phenomenon.	Phase.	Aperture of Telescope.	Mag. Power.	Greenwich Mean Time of Observation.	Mean Time of Nautical Almanac.
1889.						h m s	h m s
July 13	III.	Tr. Ingr.	Ext. contact	8-inch	70	21 32 52	
13	III.	,,	Bisection	,,	,,	21 38 21	21 39
13	III.	,,	Int. contact	,,	,,	21 44 10	
14	III.	Tr. Egr.	Int. contact	,,	,,	0 19 4	
14	III.	,,	Bisection	,,	,,	0 25 3	0 32
14	III.	,,	Ext. contact	,,	,,	0 31 47	
Sept. 5	III.	Ecl. R.	First seen	,,	75	20 37 30	20 39 55
5	III.	,,	Full brightness	,,	,,	20 43 15	
12	III.	Ecl. D.	Last seen	,,	,,	21 44 18	21 43 4
25	I.	Ecl. R.	First seen	,,	,,	22 55 31	22 55 41
25	I.	,,	Full brightness	,,	,,	22 58 11	
30	II.	Tr. Ingr.	Ext. contact	,,	110	22 44 40	
30	II.	,,	Bisection	,,	,,	22 46 5	22 39
30	II.	,,	Int. contact	,,	,,	22 48 9	

Remarks.

May 9.—Unsatisfactory observation through thin cloud. Planet free from cloud 20 seconds subsequently, but satellite not then visible.

May 21.—Sky beautifully clear, but Moon in last quarter. Slight tremor of images at moment of final disappearance.

June 1, 2.—Fair definition at ingress, and better at egress. Planet low, and boiling at occultation phase.

June 9.—Images steady and well defined. Sky clear and observation good.

June 10.—Definition pretty good at the occultation phase and at the first two phases of the transit egress. Image very much disturbed at the external contact.

June 12, 13.—Definition bad and observations unsatisfactory.

June 16, 17.—Sky beautifully clear. Images steady and well defined at the eclipse, but the Moon had risen. Images rather tremulous at transit egress.

June 21.—Good definition, but observation very difficult. No internal contact occurred.

June 24.—Steadiness and definition satisfactory.

June 25.—Good definition, but observed time rather late. The reappearance from eclipse could not be observed.

June 28.—Sky beautifully clear. Planet low and badly defined at the occultation. Definition good for the eclipse.

July 6.—Images steady and well defined, but power not sufficiently high for satisfactory observation.

July 9.—Images steady and well defined. Good observation.

July 13, 14.—Definitions unusually good at both ingress and egress. The satellite crossed a portion of the planet's disc as a dark spot.

Sept. 5.—Sky clear about the planet. The first recorded time is probably 10 or 15 seconds late.

Sept. 12.—Sky beautifully clear, and definition good.

Sept. 25.—Sky clear, but images tremulous and badly defined.

Sept. 30.—Images steady and definition good. There is a considerable discrepancy between the computed and observed times.

Note.—No occulting bar has been employed in the eclipse observations. The times given in the first and seventh columns are the Windsor mean times of observation diminished by $10^h\ 3^m\ 20^s{\cdot}5$ and entered to the nearest second.

Windsor, N.S. Wales:
1889 *December* 27.

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Ephemeris for Physical Observations

Greenwich Noon		Angle of Position of ♃'s Axis. P	L–O.	Latitude of Earth above ♃'s Equator. B	Latitude of Sun above ♃'s Equator. R	Annual Parallax. Λ–L.	Longitude of ♃'s Central Meridian. (877°·90) I.	Longitude of ♃'s Central Meridian. (870°·27) II.	Corr. for Phase.
1890		°	°	°	°	°	°	°	°
Mar.	23	343·946	170·226	–0·780	–1·006	– 9·410	229·38	130·72	+0·39
	28	343·646	171·081	·739	0·985	9·839	298·37	161·56	·42
Apr.	2	343·366	171·890	·699	·963	10·221	7·42	192·46	·45
	7	343·106	172·650	·660	·941	10·554	76·53	223·42	·48
	12	342·867	173·358	·622	·919	10·835	145·71	254·44	·51
	17	342·649	174·010	·585	·898	11·060	214·95	285·53	·53
	22	342·453	174·602	·549	·876	11·225	284·26	316·68	·55
	27	342·280	175·131	·515	·854	11·326	353·63	347·90	·56
May	2	342·129	175·595	–0·483	–0·832	–11·361	63·07	19·19	+0·56
	7	342·001	175·990	·453	·810	11·327	132·57	50·54	·56
	12	341·897	176·313	·424	·787	11·221	202·15	81·96	·55
	17	341·817	176·561	·397	·765	11·040	271·80	113·45	·53
	22	341·762	176·733	·373	·743	10·782	341·51	145·02	·51
	27	341·731	176·826	·352	·720	10·445	51·29	176·65	·48
June	1	341·724	176·840	–0·333	–0·698	–10·029	121·14	208·34	+0·44
	6	341·743	176·774	·316	·675	9·534	191·05	240·09	·40
	11	341·786	176·630	·302	·653	8·959	261·02	271·91	·35
	16	341·854	176·408	·291	·630	8·305	331·05	303·79	·30
	21	341·946	176·111	·283	·608	7·577	41·12	335·71	·25
	26	342·061	175·743	·277	·585	6·778	111·24	7·68	·20
July	1	342·198	175·310	–0·274	–0·562	– 5·914	181·40	39·69	+0·15
	6	342·355	174·818	·274	·559	4·990	251·59	71·72	·11
	11	342·531	174·275	·277	·517	4·014	321·80	103·78	·07
	16	342·723	173·689	·281	·494	2·996	32·01	135·84	·04
	21	342·927	173·071	·288	·471	1·945	102·22	167·90	+0·02
	26	343·142	172·432	·297	·448	– 0·873	172·41	199·94	·00
	31	343·362	171·784	·307	·425	+ 0·210	242·58	231·95	·00
Aug.	5	343·584	171·137	–0·318	–0·402	+ 1·291	312·71	263·93	–0·01
	10	343·804	170·504	·331	·379	2·357	22·78	295·86	·02
	15	344·018	169·896	·344	·356	3·399	92·79	327·72	·05
	20	344·221	169·324	·357	·332	4·406	162·73	359·51	·08
	25	344·409	168·798	·370	·309	5·366	232·59	31·22	·13
	30	344·579	168·328	·382	·286	6·272	302·37	62·85	·17
Sept.	4	344·727	167·920	–0·394	–0·263	+ 7·116	12·05	94·38	–0·22